CLAIMS

01)-System for a sleeve-type packaging machine, which wraps pieces (2) of packaging material around articles (1), in which the said packaging machine comprises: >-first article conveyor means (10), for feeding the articles (1) longitudinally in sequence and spaced apart from each other; >-second article conveyor means (20), located downstream and at a small distance from the said first article conveyor means (10), thus creating a first opening (A1) between the said first (10) and the said second (20) article conveyor means, the second means being able to receive the articles arriving from the said first article conveyor means (10) and to carry the said articles (1) along a wrapping plane which has an entry end and an exit end; >-third article conveyor means (30), located downstream and at a small distance from the said second article conveyor means (20), thus creating a second opening (A2) between the said second (20) and the said third (30) article conveyor means, the third means being able to receive the articles (1) arriving from the said second article conveyor means (20); >-means (40) for wrapping the pieces of sheet, located in the proximity of the said second article conveyor means (20), and comprising at least one suspended wrapping bar (41), orientated transversely with respect to the direction of advance of the articles (1), and made to move through the said first (A1) and the said second (A2) opening along an orbital path passing over the top of the said second article conveyor means (20), the bar being capable of carrying the pieces (2) of wrapping material; >-piece conveyor means (50) with a conveyor belt (51), positioned longitudinally below and in alignment in the proximity of the said first opening (A1), for feeding the pieces (2) of packaging material in the proximity of the said first opening (A1); and >-control means (70) for controlling and synchronizing the said operating means, **characterized in that** it comprises a first modular unit (T100-G100) which is located under the article conveyor means (10) and is movable and positionable with respect to the packaging machine, for forming and feeding pieces (S1) of packaging material, this unit being functionally connected to the control unit (70); **in that** it comprises a second modular unit (T200-G200) which is located under the article conveyor means (10) and is movable and positionable with respect to the packaging machine, for forming and feeding pieces (S2) of packaging material, this unit being functionally connected to the control unit (70); and **in that** the said first modular unit (T100-G100) and the said second modular unit (T200-G200) can assume at least two positions,

namely a first position in which the modular unit (T100-G100; T200-G200) is positioned at least transversely at the side of the packaging machine, and a second position, in which the modular unit (T100-G100; T200-G200) is positioned under the packaging machine in order to feed the pieces (S1, S2) towards and above the conveyor belt (51) of the piece conveyor means (50).

02)-System according to claim 1, **characterized in that** the said first modular unit (T100-G100) comprise a frame with lateral plates (101a-101b) which are parallel, interconnected and spaced apart from each other, and **in that** the following components are supported between the said plates (101a-101b): -support means (110) for supporting a reel (B100) of packaging sheet (N1); -first sensor means (120) for detecting when the reel (B100) has been used up; -unwinding means (130) for unwinding the sheet (N1) wound on the reel (B100), -cutting means (140) for cutting the sheet (N1), and -feed means (150) for feeding the pieces (S1) towards and above the conveyor belt (51).

03)-System according to claim 1, **characterized in that** the said second modular unit (T200-G200) comprise a frame with lateral plates (201a-201b) which are parallel, interconnected and spaced apart from each other, and **in that** the following components are supported between the said plates (201a-201b): -support means (210) for supporting a reel (B200) of packaging sheet (N2); -first sensor means (220) for detecting when the reel (B200) has been used up; -unwinding means (230) for unwinding the sheet (N2) wound on the reel (B200), -cutting means (240) for cutting the sheet (N2), and -feed means (250) for feeding the pieces (S2) towards and above the conveyor belt (51).

04)-System according to claim 1, **characterized in that** additional second sensor means (53) are provided along the transport branch of the piece conveyor means (50) for detecting the front and rear edges of the pieces (S1; S2) being fed towards the said first opening (A1), and **in that** the said second sensor means (53) are connected to the control means (70).

05)-System according claim 1, **characterized in that** the said control means (70) are able to modify the motion of the said piece conveyor means (50) with respect to the motion of the article conveyor means (10, 20, 30) in order to produce the correct synchronization between the said pieces (S1; S2) being moved towards the said first opening (A1) and the articles (1) being moved towards the same first opening (A1).

06)-System according to claim 5, **characterized in that** the said piece conveyor means (50) are driven by a corresponding servo motor (M50) connected to the control means (70) and **in that** the said control means (70) are able to modify the speed of the said servo motor (M50) of the conveyor means (50).

07)-System according to claim 2, **characterized in that** the said control means (70) are able to modify the speed of the unwinding means (130; 230) and the speed of the feed means (150; 250) with respect to the speed of the piece conveyor means (50).

08)-System according to Claim 7, **characterized in that** the unwinding means (130; 230) and the feed means (150; 250) are driven by a corresponding servo motor (M100; M200) connected to the control means (70) and **in that** the said control means (70) are able to modify the speed of the said servo motor (M100; M200) of the unwinding means (130; 230) and of the feed means (150; 250).

09)-System according to claim 2, **characterized in that** the said first modular unit (T100-G100) and the said second modular unit (T200-G200) include additional corresponding third sensor means (170; 270) for detecting marks located along the sheet (N1, N2), **in that** the said third sensor means (170; 270) are connected to the control means (70), **in that** the said cutting means (140; 240) are operated by an actuator (M140; M240) connected to and controlled by the control means (70), and **in that** the said control means (70) are able to drive the actuator (M140; M240) of the cutting means (150; 250) in synchronization with the position reached by the sheet (N1; N2) as detected by the aforesaid third sensor means (170; 270), in order to cut the pieces in a specified longitudinal position with respect to the said marks.

10)-System according to claim 1, **characterized in that** additional fourth sensor means (54) are provided along the transport branch of the piece conveyor means (50), for detecting marks located longitudinally along the pieces (S1; S2), **in that** the said fourth sensor means (54) are connected to the control means (70), and **in that** the said control means (70) are able to modify the motion of the said piece conveyor means (50) with respect to the motion of the article conveyor means (10, 20, 30) in order to produce the correct synchronization between the said pieces (S1; S2) being moved towards the said first opening (A1) and the articles (1) being moved towards the same first opening (A1).

11)-System according to claim 1, in which the fixed frame (1) of the packaging machine has two walls (Fa, Fb), **characterized in that** it comprises in the said walls (Fa, Fb) at least a first opening (B1, B2, B3, B4, B5) of sufficient size to allow the free transverse sliding of the first modular unit (T100-G100) and at least a second opening (C1, C2, C3, C4, C5) for allowing the free transverse sliding of the second modular unit (T200-G200).

12)-System according to claim 1, **characterized in that** the said first modular unit (T100-G100) and the said second modular unit (T200-G200) feed the pieces (S1, S2) in two separate areas located respectively upstream and downstream on the working branch of the conveyor belt (51) of the piece conveyor means (50), **in that** for a change of reel from the first modular unit (T100-G100) to the second modular unit (T200-G200) the said second modular unit (T200-G200) is operated for a specified period before stopping the first modular unit (T100-G100), and **in that** for a change

of reel from the second modular unit (T200-G200) to the first modular unit (T100-G100) the said second modular unit (T200-G200) is stopped and the first modular unit (T100-G100) is operated after a specified period following this stop.

13)-System according to claim 1, **characterized in that** a first modular unit (T100-G100) is positioned under the article conveyor means (10) with the branch (R100) for feeding the pieces (S1) positioned at a first level and terminating in the proximity of the belt (51) of the piece conveyor means (50) and **in that** a second modular unit (T200-G200) is positioned under the said piece feeding branch (R100) of the first modular unit (T100-G100) with the branch (R200) for feeding the pieces (S2) positioned at a second level below the aforesaid branch (R100) and terminates in the proximity of the belt (51) of the piece conveyor means (50).

14)-System according to claim 2, **characterized in that** the said first modular unit (T100-G100) and the said second modular unit (T200-G200) include additional respective fifth sensor means (160; 260) connected to the control means (70) for detecting the tension of the sheet (N1; N2) being unwound, **in that** the said first modular unit (T100-G100) and the said second modular unit (T200-G200) include additional respective servo motors (M110, M210) for rotating the respective reels (B100; B200), and **in that** the said control means (70) use the said servo motors (M110, M210) of the reels (B100; B200) to control the rotation of the respective reels (B100; B200) according to the signals received from the aforesaid fifth sensor means (160; 260).

15)-System according to claim 1, **characterized in that** the said control means (70) include a packaging cycle control program, **in that** the modular units (T100-G100; T200-G200) can be dissociated functionally from the first packaging cycle control program, and **in that** after this dissociation the various working elements (110, M110, 130, 140, M140, 150, M100; 210, M210, 230, 240, M240, 250, M200) of the dissociated modular unit (T100-G100; T200-G200) can be operated singly and independently.

16)-System according to claim 1, **characterized in that** the said control means (70) include a first packaging cycle control program and a second piece forming control program, **in that** the said second piece forming program can run independently of the first packaging cycle control program, **in that** the modular units (T100-G100; T200-G200) can be dissociated functionally from the first packaging cycle control program, and **in that** after this dissociation the said second piece forming program is designed to operate and control the working elements (110, M110, 120, 130, 140, M140, 150, M100, 160; 210, M210, 220, 230, 240, M240, 250, M200, 260) of the first or the second dissociated modular unit (T100-G100 or T200-G200) in order to form and feed pieces (S1 or S2).

17)-System according to Claim 16, **characterized in that** the said second piece forming control program can be used to enter new parameters for changing the format of the pieces which are to be produced.

18)-System according to claim 1, **characterized in that** the said control means (70) include a packaging cycle control program, **in that** the said first modular unit (T100-G100) or the said second modular unit (T200-G200) for forming and feeding the pieces (S1; S2) additionally includes respective servo motors (M110, M210) for rotating the respective reel (B100; B200), and **in that** during the change of reel the packaging cycle control program rotates the new reel (B100; B200) by activating the corresponding servo motor (M110; M210) of the reels (B100; B200).

19)-System according to claim 1, **characterized in that** the said control means (70) include a packaging cycle control program, **in that** the said first modular unit (T100-G100) or the said second modular unit (T200-G200) for forming and feeding the pieces (S1; S2) additionally includes respective servo motor (M110, M210) for rotating the respective reel (B100; B200), and **in that** during the change of reel the packaging cycle control program stops the corresponding used reel (B100; B200) by activating the corresponding servo motor (M110; M210) of the reels (B100; B200).

20)-System according to claim 1, **characterized in that** the said control means (70) include a packaging cycle control program, **in that** the said first modular unit (T100-G100) or the said second modular unit (T200-G200) for forming and feeding the pieces (S1; S2) additionally include respective sixth sensor means (160; 260) for

detecting the tension of the sheet (N1; N2) being unwound, **in that** the said sixth sensor means (160; 260) are connected to the control means (70), **in that** the said first modular unit (T100-G100) or the said second modular unit (T200-G200) for forming and feeding the pieces (S1; S2) additionally include respective servo motor (M110, M210) for rotating the respective reel (B100; B200), and **in that** the said packaging cycle control program controls the said servo motor (M110; M210) of the reels (B100; B200) in order to optimize the unwinding of the sheet (N1; N2) from the corresponding reel (B100; B200).

21)-System according to claim 1, **characterized in that** the first modular unit (T100-G100) is fitted with a first reel (B100) and a corresponding first sheet (N1), **in that** the second modular unit (T200-G200) is fitted with a second reel (B200) and a corresponding second sheet (N2) which are different from the first reel (B100) and the first sheet (N1), and **in that** a packaging cycle control program is provided which operates the first and second modular units (T100-G100, T200-G200) alternately, in such a way that a specified sequence of different pieces (S1-S2-S1, etc., or S1-S1-S2-S1-S1-S2, etc.) is formed on the conveyor belt (51) of the piece conveyor means (50).

22)-System according to claim 1, **characterized in that** it comprises: >-a first servo motor (M10), connected to and controlled by the synchronization means (70), for driving the said article conveyor means (10, 20, 30); >-a second servo motor (M40), connected to and controlled by the synchronization means (70), for driving the said wrapping means (40); >-a third servo motor (M50), connected to and controlled by the synchronization means (70), for driving the said piece conveyor means (50); and >-a fourth and fifth servo motor (M100; M200), connected to and controlled by the

synchronization means (70), for driving, respectively the said first and the said second modular unit (T100-G100; T200-G200).